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National Forests PROVIDE WATER FOR ARIZONA

U. S. Department of Agriculture
Forest Service... Southwestern Region

Approved as a teaching aid
in Arizona Schools
by the
State Superintendent
of Public Instruction

MOST OF ARIZONA'S WATER COMES FROM NATIONAL FORESTS

What would Arizona be like if three-fourths of its water supply were taken away? There would be no large cities, little agriculture and industry and very few people. This is an unpleasant prospect and one that is not likely to come true, but it shows the importance of water and the National Forest lands from which it comes.

Seventy-four percent of Arizona's usable water comes from National Forests, although they make up only 15.7 percent of the State's 72,688,000 acres.

Why do Forest lands produce more water per acre than most lower lands? First, because more water falls at higher elevations where southwestern forests grow. Also, because temperatures are lower in the high forest lands and there is less water lost by evaporation. Forest soils are usually quite porous and covered with needles and leaves. This surface slows down water, allowing it to seep into the ground for future use, rather than quickly running off, as often happens in lower lands.

Water is the lifeblood of Arizona. Combined with soil it forms the foundation of our existence.

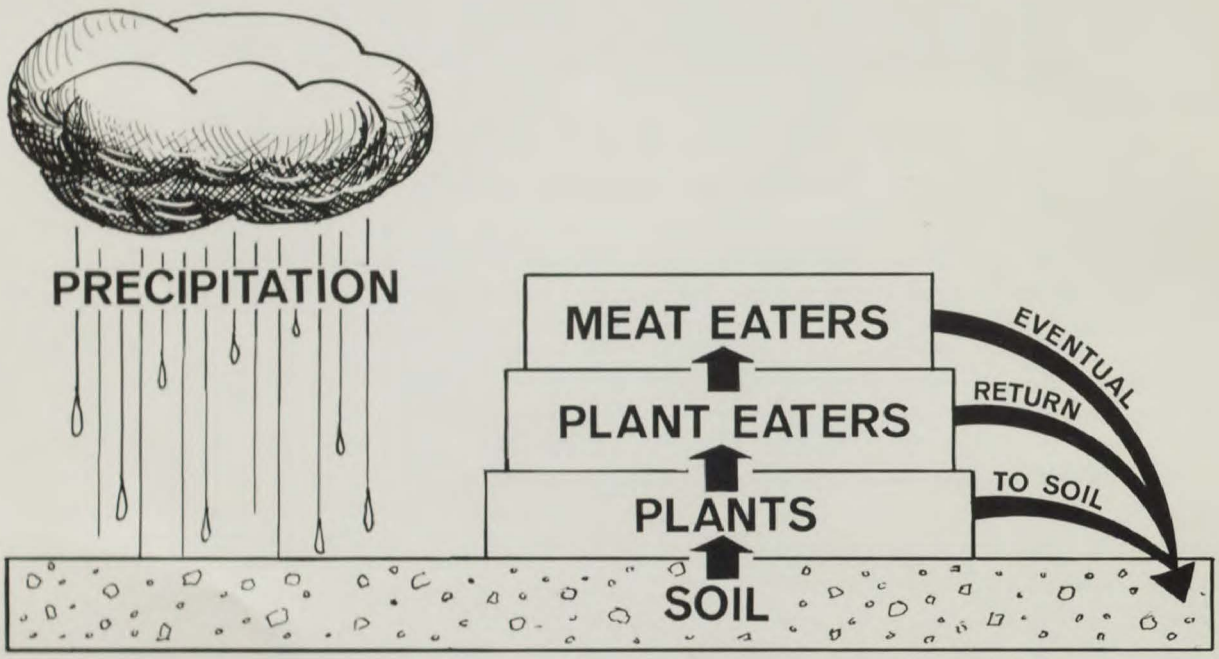
LIFE IN ARIZONA DEPENDS ON WATER FROM NATIONAL FORESTS

Plants are the first source of all foods. Among all living things, only plants can convert water, air, and minerals from the soil into proteins, fats, and carbohydrates. Man and other animals feed on plants or on meat from animals which eat plants.

Without water, plants cannot grow, and the flow of nutrients from soil to plants to animals is impossible. Water is a vital link in man's food supply chain. It makes life possible and pleasant in an otherwise dry land.

Soil and water grow forage for livestock that produce meat for American tables.

Water from National Forests irrigates crops for food and fiber.



Water is a vital resource for human use and recreation.

Lakes on National Forests are favorite places for fishing and enjoying natural beauty.

WATER HELPS TO DETERMINE THE APPEARANCE OF ARIZONA'S SCENIC LANDSCAPES

The amount and availability of water is a major factor determining the plant and animal life and thus the general appearance of the land.

DESERT

The low semi-desert gets a mere 3 to 10 inches of rain each year. Only desert shrubs, paloverdes, cacti and hot-weather grasses can grow here. Elevation is usually less than 4,000 feet.

GRASSLANDS

The grasslands at 3,000 to 6,000 feet elevation get 9 to 18 inches of rainfall. They produce the nutritious grasses that support the valuable grazing industry, along with scrub oak, rabbit brush, yucca, saltbush, and other shrubs.

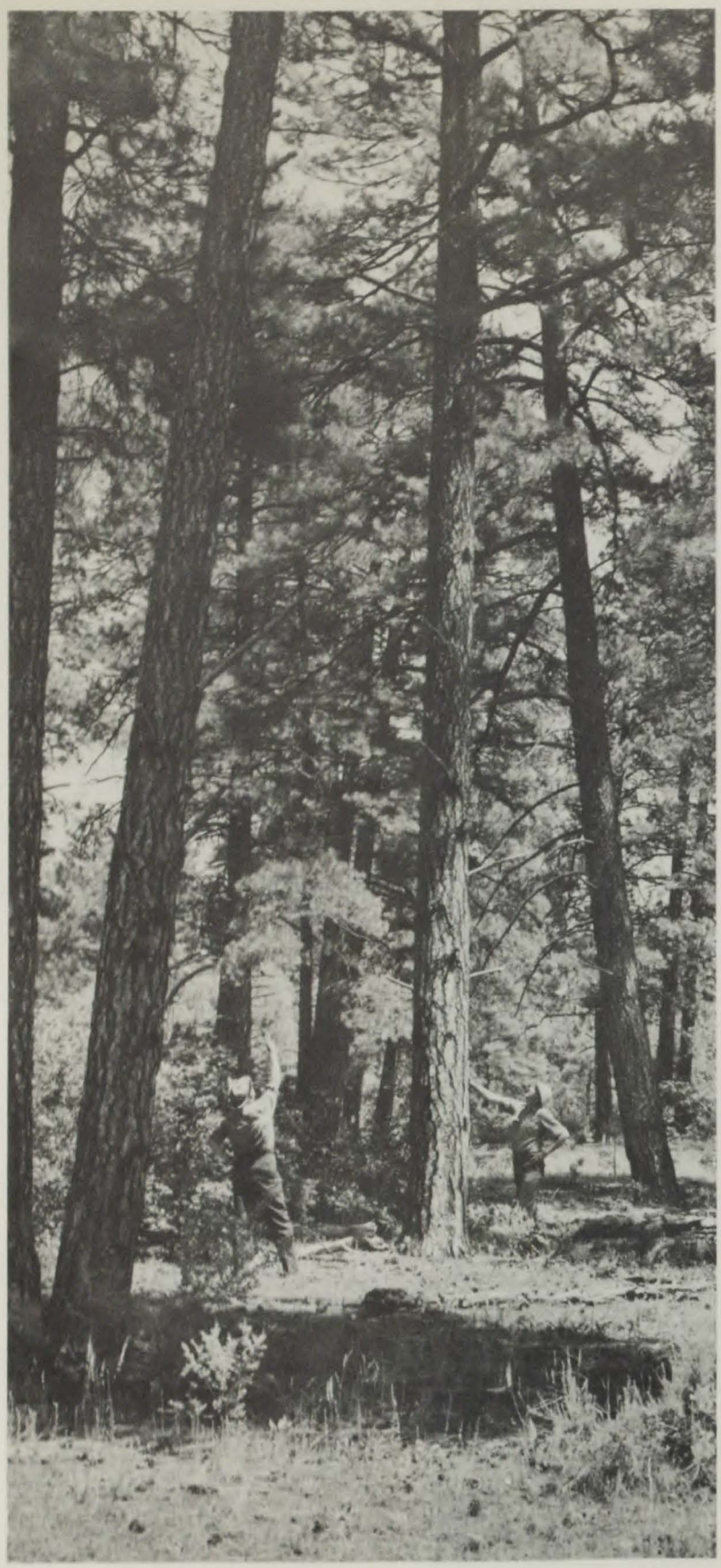
PINYON-JUNIPER WOODLAND

Go higher, to the 5,000-7,000 foot levels, where 12 to 20 inches of water fall, and plant life changes again. Under these conditions in northeastern Arizona pinyon and juniper dot the landscape.

Early man in the southwest liked the combination of temperature, water, and plants in the pinyon-juniper woodland. He built many cliff dwellings, pueblos, and villages in this vegetation type.

CHAPARRAL

Average annual rainfall in the chaparral zone is 13 to 25 inches. The zone occurs at about the same elevation as pinyon-juniper woodland, but in central Arizona. Typical plants are shrub live oak, manzanita, cliff rose, and ceanothus.

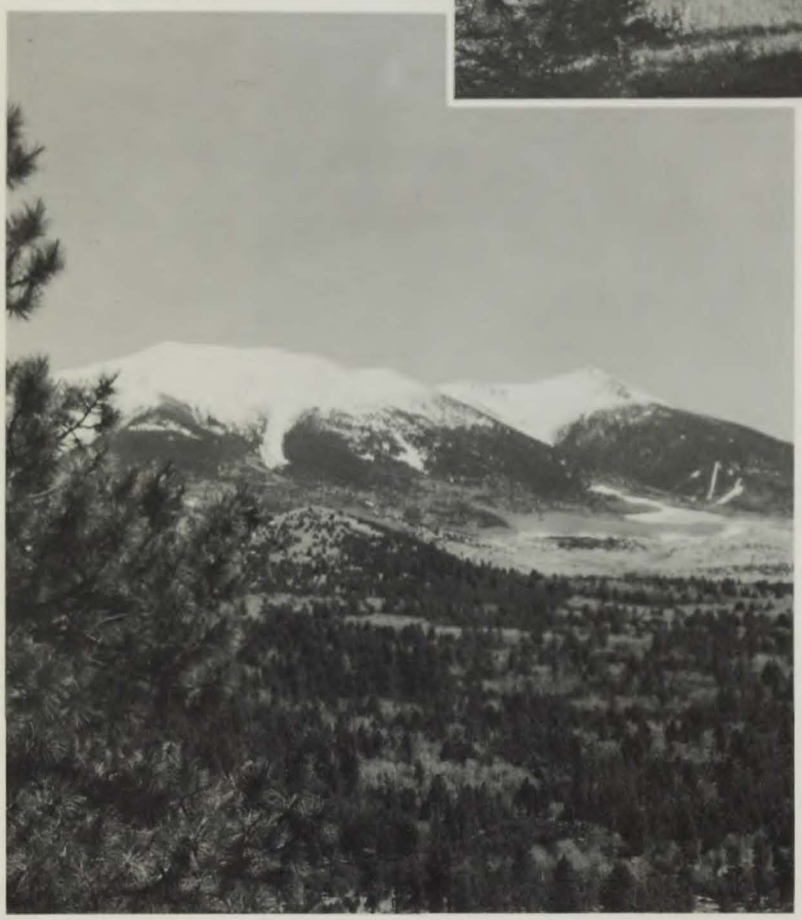


PONDEROSA PINE FOREST

The ponderosa pine forest overlaps the pinyon-juniper woodland beginning at about 5,500 feet elevation, and extends to 8,500 feet. Average precipitation is 19 to 25 inches. More high-quality lumber comes from ponderosa pine forests than from any other zone, as well as much water for the valleys below.

SPRUCE-FIR FOREST

Move upward again, to 8,000 to 11,500 feet where pines, firs, and spruces tower above a cool, needle-covered forest floor. The forest here gets 25 or more inches of water from rain and snow, much of it finding its way to the valleys below. This vegetation type yields more water than any other. Most of the water that sustains agriculture and industry comes from here. Before it evaporates, to fall again some other place, it provides recreation, natural beauty, and many additional benefits to man and other living things.



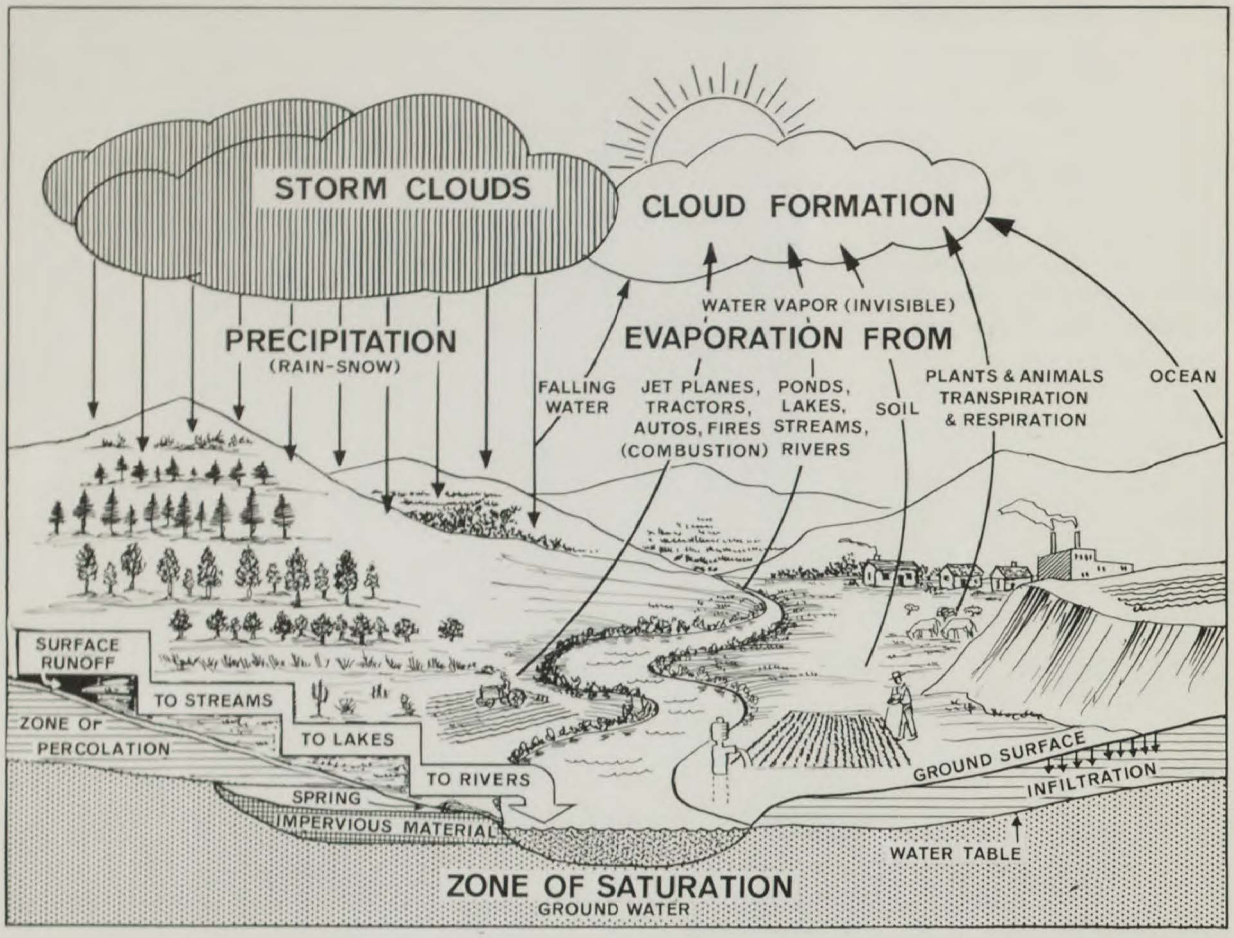
ALPINE TUNDRA

In Arizona the treeless arctic alpine zone is only found above timberline at the summit of San Francisco Peaks. Water production per acre is high, but because of its smaller area, total water production is much less than that from the spruce-fir forests.

NATIONAL FORESTS ARE AN IMPORTANT PART OF THE WATER CYCLE

The "Water Cycle" is a system of regular steps or stages through which water passes. From its liquid form in oceans, lakes, streams, and soil, water evaporates to become a gas called water vapor. Invisible in small quantities, water vapor becomes visible clouds when it is concentrated and cooled.

Under certain conditions the atmosphere cannot retain in cloud form all the water present. Then it condenses into drops or crystalizes into flakes and falls as rain or snow.



A number of things can happen to this water after it falls. It may evaporate immediately from soil or plants. It may flow over the land surface as creeks or rivers. Some stands in ponds, lakes, or reservoirs for days or weeks before moving on. That which enters the ground may move along just under the surface or go deeper to become part of the huge water mass called ground water held in sands, gravels, or porous rocks.

The water cycle involves a dynamic, neverending, everchanging flow from water vapor in the air, through precipitation to surface or ground water, evaporation, and back to water vapor. A thousand paths are followed, never twice the same, with plant cover, slope, soil texture, and temperature constantly interacting to govern rate and kind of movement.

PINE-FIR-SPRUCE FORESTS PROVIDE MOST OF ARIZONA'S WATER

In no other life zone is water movement more regular or predictable than in the pine-fir-spruce (mixed conifer) forests that produce most of Arizona's water. Good protection and management of this vital water source is necessary if the prosperity of Arizona's people and the beauty of its landscapes are to be maintained.

GOOD FOREST MANAGEMENT PROTECTS WATER RESOURCES

In areas where water falls and flows, wild fire and erosion must be controlled. Logging, grazing, and human use must be managed to prevent damage to these watersheds and to encourage sustained production for the benefit of the greatest numbers of people for the longest period of time.

Careful management and use of forest lands results in many water-related benefiits such as:

—decreasing damage from soil erosion

—clearer, more attractive streams and lakes

—preventing or limiting flood damage

—a stable, adequate, year-around water supply to meet human needs.

Planned timber harvest provides for protection of vital watersheds and restoring natural beauty on cutting areas.

Smokey says,

"Good forest management includes preventing wildfires."

Forest fires destroy precious ground cover and thus damage the water producing capacity of forest land.

MULTIPLE USE MANAGEMENT FOR SUSTAINED YIELD

Water is one of the renewable natural resources found on National Forests. Others are timber, forage, wildlife, and recreation. The Forest Service is charged with managing these resources so that they are used in the best way to meet the needs of the American people. The Forest Service calls this "Multiple Use Management."

Wood, water, forage, wildlife, and recreation resources never occur singly on Forest lands. They always occur in combination, but amount, type, and quality of each varies from area to area. This means that their use and management will vary from area to area. On some land, all resources will be about equally used. On other areas, one, two, or more resources may be used much more intensively than the others. MULTIPLE USE MANAGEMENT FINDS AND APPLIES THE BEST COMBINATION OF USES ON A PARTICULAR AREA OF LAND AT A PARTICULAR TIME, TO MEET THE LOCAL, REGIONAL AND NATIONAL NEEDS OF THE AMERICAN PEOPLE.

As needs change uses may change. Also, use is controlled so that lands ability to produce is not impaired. This is management for "sustained yield."

ARIZONA'S PEOPLE CAN PROTECT NATIONAL FOREST WATER

People determine what happens to natural resources, including water. By strongly expressing their opinions they may influence policy-making and water conservation programs. Peoples' opinions and actions begin with concern, accurate information, and an understanding of the relationship of water to other resources, to local and regional needs, and to the development of communities.

The desire and ability to evaluate information, form defensible opinions, and take effective action is not quickly acquired. It is often based on an early interest in the out-of-doors, an understanding of personal dependence upon natural resources, and a strong desire to lead or take part in meaningful action. These qualities can be developed by teachers and youth leaders using effective teaching methods and aids. Successful environmental education programs will help to insure the future of Arizona's water supplies and other natural resources.

REFERENCES ON WATER AND YOUR NATIONAL FORESTS

1. YOUR WATER SUPPLY AND FORESTS. Agriculture Information Bulletin 305, 1966. U.S. Department of Agriculture, Forest Service.

2. WATERSHEDS — Forestry Co-Project No. 1, Science Clubs of America — High Schools. Pamphlet 0-42, 1959, USDA, Forest Service.

3. FORESTS AND WATER, Pamphlet 0-28, 1963. USDA, Forest Service.

4. WATER — the Yearbook of Agriculture, 1955, USDA.

5. NATIONAL FORESTS ARE FOR PEOPLE, Leaflet, 1966. USDA, Forest Service.

6. NATURAL BEAUTY IN THE SOUTHWESTERN NATIONAL FORESTS — 1968. USDA, Forest Service.

7. YOUR NATIONAL FORESTS IN ARIZONA. 16" x 20" wall chart with colored map of National Forests in Arizona.

FILMS AND FILMSTRIPS

1. THE ADVENTURES OF JUNIOR RAINDROP. 16 mm., sound, color, 8 minutes. Elementary grade level.

2. MOUNTAIN WATER. 16 mm., sound, color, 17 minutes. Teaching quiz available. Junior high to adult level.

3. VIEWPOINT. 16mm., sound, color, 25 minutes. (The story of National Forests by Bob Bray, who played District Forest Ranger Corey Stuart in the early Lassie TV series.) Suitable for all age levels.

4. WATER FOR THE WEST. 16mm., sound, color, 25 minutes. Shows the work of field men and scientists to increase water yield without damaging watersheds. Junior high to adult level.

5. LITTLE SMOKEY. 16 mm., sound, color, 12 minutes. The story of Smokey, the forest fire preventin' bear. Suitable for all age levels.

6. OUR NATIONAL FORESTS—Filmstrip (or slide) set. 41 frames, with printed narration. March, 1966. Suitable for all age levels.

To obtain the references and films listed above, contact the Forest Service office that is nearest to your school. There is no charge for these services.

Well-managed forest watersheds produce clear, cool, clean water for the valleys below.

FOR FURTHER INFORMATION CONTACT:

Apache National Forest Supervisor
at Springerville.

District Rangers at Springerville,
Alpine, and Clifton, Ariz., and Luna
and Quemado, N. M.

Coconino National Forest Supervisor
at Flagstaff.

District Rangers at Flagstaff, Beaver
Creek, Blue Ridge, Happy Jack,
Sedona.

Coronado National Forest Supervisor
at Tucson.

District Rangers at Tucson, Douglas,
Nogales, Patagonia, Safford, Willcox.

Kaibab National Forest Supervisor
at Williams.

District Rangers at Williams, Fredonia,
Tusayan.

Prescott National Forest Supervisor
at Prescott.

District Rangers at Prescott, Chino Valley,
Crown King, and Camp Verde.

Sitgreaves National Forest Supervisor
at Holbrook.

District Rangers at Winslow, Overgaard,
Lakeside, and Snowflake.

Tonto National Forest Supervisor
at Phoenix.

District Rangers at Cave Creek, Globe, Mesa,
Payson, Young, Roosevelt, and Tonto Basin.

Regional Office: U.S. Forest Service
Southwestern Region
517 Gold Avenue, SW
Albuquerque, New Mexico 87101

SOME ACTIVITIES TO TEACH RELATIONSHIP OF FOREST AND WATER RESOURCES

1. Concept—Average annual precipitation increases and average annual temperatures drop as elevation increases.

   Have students write for average annual precipitation and average annual temperature records from Weather Bureau stations or Chambers of Commerce in (1) desert areas up to 4,500 feet elevation, such as Gila Bend, Tucson, Safford; (2) grassland areas 3,000 to 6,000 feet elevation, such as Holbrook, Winslow, St. Johns; (3) chaparral areas 4,000 to 5,500 feet elevation, such as Prescott, Camp Verde; (4) pinyon-juniper lands up to 7,500 feet elevation such as Sedona; and (5) ponderosa pine or mixed-conifer areas in the 5,500-10,000 foot levels such as Flagstaff, Show Low, Alpine.

   (To make it easier for weathermen, and to assure comparable data, send a form with blanks to be filled in with local average records and returned in a stamped, self-addressed envelope.)

   Use the data to make a graph or chart showing relationship of elevation, precipitation, and temperature.

   What does this information suggest about the water producing value of high elevations in Arizona?

2. Concept—Forested areas are the sources of most of the streams in the State.

   Map the major rivers and streams in Arizona. Where do most of these streams begin? (Where are the "headwaters"?)

Young people build a stream improvement structure to prevent erosion.

3. Concept—the combination of climatic factors (temperature, humidity, wind, sunlight, precipitation) generally found in high-elevation National Forests produces more water than contrasting low-elevation areas.

   Visit two areas, one at a high elevation in a National Forest and the other at a lower elevation. Compare the temperature, humidity, soils, streamflow, wind velocity, plant life, and sunlight that reaches the soil.

   (Study procedures: In each area take temperature in the shade; hang equally damp paper towels in the shade and record the time it takes for them to dry; collect soil samples for later study; observe stream flow; estimate wind velocity at waist level; observe and record variety and abundance of plant life, use a camera light meter pointed at the palm of your hand to measure intensity of sunlight.)

   What conclusions can you draw about the relative production of water from the two environments studied?

4. Concept—Water is found in several forms and in many places.

   Collect photographs from magazines to show the forms and paths that water takes as it moves in the water cycle. (Clouds, rain, snow, snow drifts in forests, creeks, springs, lakes or reservoirs, rivers, the ocean, sunshine on water, etc.) Put these on a bulletin board or chart to make a pictorial water cycle.

5. Concept—Water is necessary for many of man's activities.

   Discuss the uses of water while it is still in the National Forests. (Skiing, natural beauty, wildlife, swimming, wading, fishing, boating, camping, picnicking, livestock water, storage, growing trees, grass and flowers.) Find photos to illustrate these uses.

6. Concept—The rate of water evaporation is affected by temperature and wind.

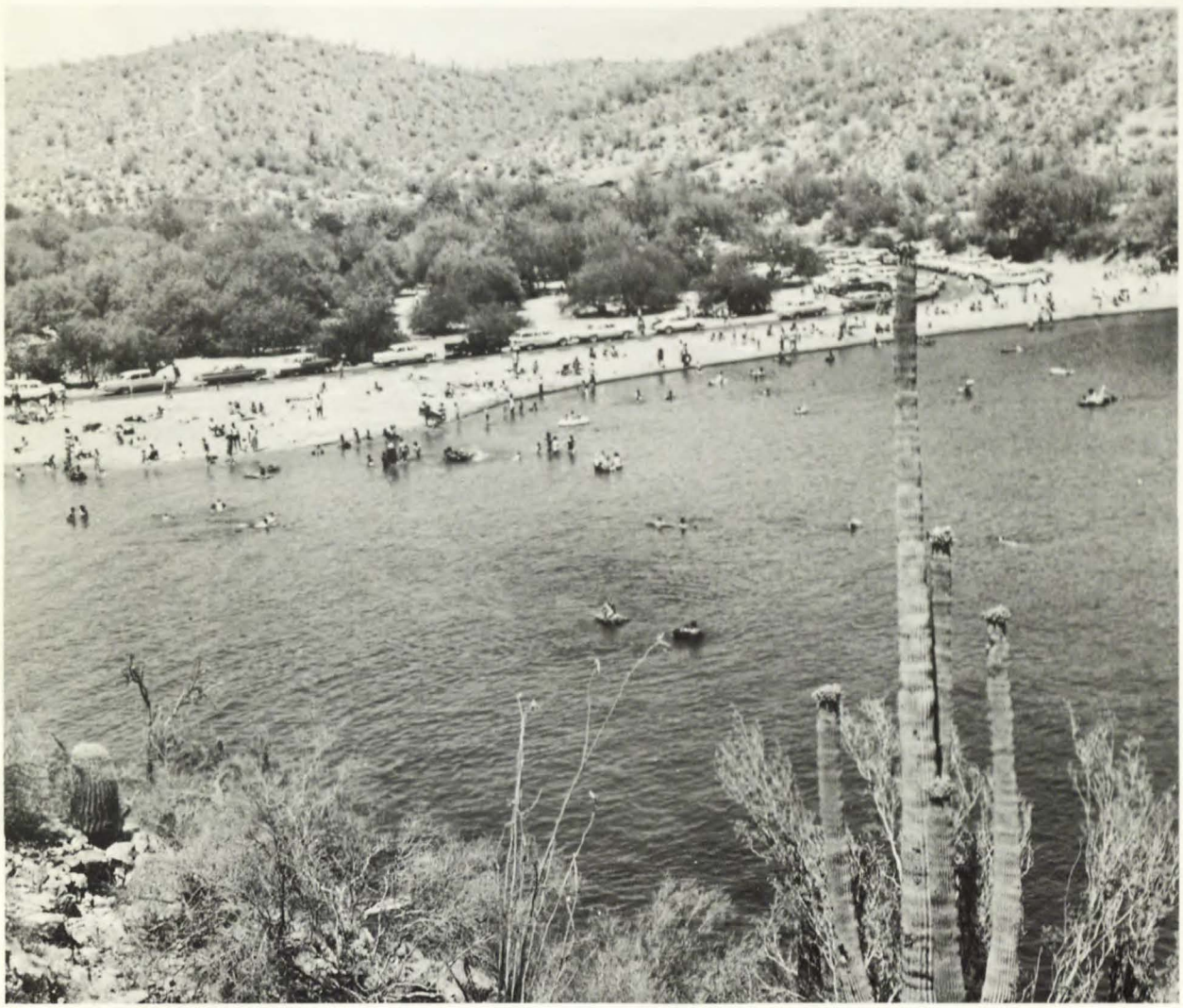
   Design and conduct an experiment to learn how water and air temperature and wind causes evaporation rate to vary. (Pans of water at different temperatures, in still air, in front of a fan, outdoors, etc.)

7. Concept—The source of domestic water may be many miles from home or school.

   Trace the water that comes from a school faucet to its source as rain or snow. (Pipes, water system, standpipe or pressure tank, pump, well or reservoir, ground water or stream, rain, snow.) Take trips to learn more about these sources of domestic water.

8. Concept—All natural resources are interrelated.

   Discuss the relationships between forest wildfires, erosion, clean water, floods, hunting and fishing, camping, reservoirs, growth of cities, and water for homes, recreation, and industry.



YOUR National Forests IN ARIZONA

National Forests in Arizona include the Kaibab, Prescott, Coconino, Sitgreaves, Tonto, and parts of the Apache and Coronado.